ADDRESSING DISTURBANCE IN THE STUDY OF ICY MOONS USING BIOMIMICRY. Bruno Cevallos[1], Gustavo Jamanca-Lino[2], Jose L. Napán[3], Arturo Flores[4] and Yury Vásquez[5], [1] Universidad Científica del Sur, Lima, Peru (brunocevallosgil@hotmail.com), [2] Colorado School of Mines (gjamancalino@mines.edu), [3] Pontificia Universidad Católica del Perú, Lima, Peru (jose.napan@pucp.pe), [4] Universidad Nacional de Ingeniería, Lima, Peru (amfloresa@uni.pe), [5] Universidad Nacional de Moquegua, Moquegua, Peru (yvasquezc@unam.edu.pe).

This work presents the conceptual design of a bio-inspired robotic probe for the exploration of aquatic environments under ice layers, such as those alleged below the surface of the Jovian moon, Europa [1]. After the success of the coming Europa Clipper [2] and JUICE [3] missions, a probe will be sent to the Galilean moon inside an ice-perforation robot, after traveling onboard a spacecraft and carefully landing on a previously selected site. On the surface, the perforation robot would travel through the crust and would deploy the underwater probe once the ice-water interface is reached [4]. A swimmer probe of this kind extends the analysis range to areas not affected by the perforation of the ice, also avoiding disturbances while evaluating the habitability and searching for biosignatures in the water column and the ice through a propulsion-stabilisation system bioinspired in the particular locomotion of a deep-sea fish [5]. The concept of this "fin-propelled in situ habitability exploration robot" (FISHER-X), was modelled using 3D design software. Based on the identified mission requirements and the most advanced probes to date tested, collecting data and samples, from polar subglacial environments, submerged caves and the bottom of the Earth ocean, among other ocean world analogues [6], materials and technology associated with navigation, power and payload sensors are proposed.

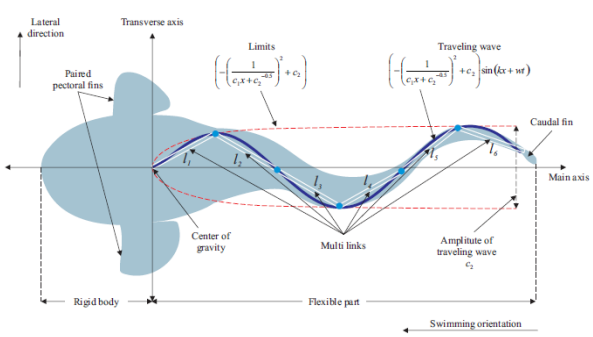

Fig. 1. Body undulation of the biological model and the bio-inspired probe described from a top-down view [5].

FISHER-X's building and testing are the first steps for an adaptable design that could be used not only on the Earth or Europa, but also on Enceladus and even Titan among other oceanic environments of the solar system. According to the recent Decadal Survey sending an orbiter and a probe to Uranus is a high priority flagship mission as the only spacecraft ever to visit this planet was the Voyager. It is worth mentioning that natural satellites of Uranus, such as Ariel and Miranda, share many features with better studied icy moons, which turn these bodies into potential ocean worlds as well.

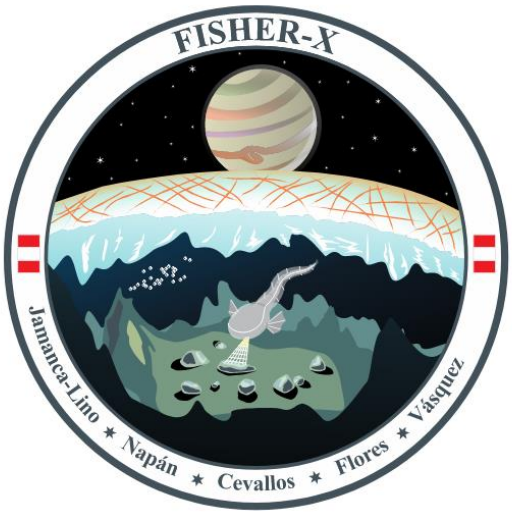

Fig. 2. Project patch of the FISHER-X 2022 team.

Finally, FISHER-X could support integrative studies as a technological tool to address environmental problems associated with human activities while their navigation and payload sensors are being tested.

References:

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